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EDUCATION

PHYSICS ACHIEVEMENT TEST

This achievement test attempts to cover the major concepts in Physics. Some items will be very elementary, while others will present greater difficulty so that the number of items each individual may be able to answer correctly will vary with each grade level. Keep in mind that if the material is unfamiliar, the item may be testing your ability to transfer and analyze information in a different situation. Therefore, it is important that you read each item carefully before attempting it. The diagrams in the test are NOT necessarily drawn to scale.

DIRECTIONS

Use ordinary HB pencil only.

Fill in the information at the top of the answer sheet as directed by the examiner.

Read each item carefully and decide which of the alternatives BEST completes the statement, or answers the question. Locate that item number on the answer sheet and fill in the space that corresponds to the alternative that you have chosen.

Mark your answers according to the instructions and the illustration given at the top of the answer sheet. Avoid placing any marks among the black timing lines along the right-hand margin of the answer sheet.

Mark ONLY ONE answer for each item. If you wish to change an answer, be sure your original choice has been completely erased.

DO NOT put any marks on this test booklet. Scrap paper will be provided.

DO NOT bend or fold the answer sheet.

Return complete TEST BOOKLET, ANSWER SHEET, DATA BOOKLET and PENCIL at the end of the period.

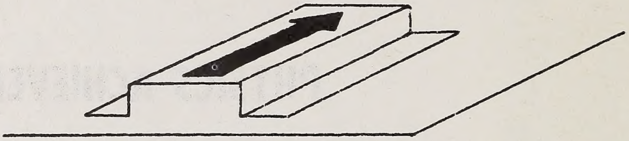
SECTION A

1. A 150 lb man stands on his toes which have a TOTAL area of 0.250 ft^2. The pressure he exerts on the floor is

   A. 37.5 lb/ft^2
   B. 75.0 lb/ft^2
   C. 300 lb/ft^2
   [✓ D. 600 lb/ft^2]

2. Suppose a paper bridge is built as in the diagram below and placed on a table. When a puff of air is blown over the bridge in the direction shown, the bridge lifts off the table. The experiment illustrates the principle that

   A. moving air is more dense than paper
   B. air exerts less pressure when it is moving than when it is at rest
   [✓ C. air exerts more pressure when it is moving than when it is at rest]
   D. air exerts pressure equally on all parts of the paper



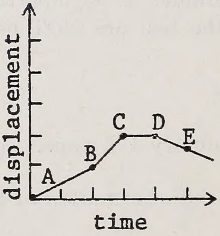
3. A 2.0 kg mass M_1 is accelerated along a frictionless table under the action of a 10 newton force. Another mass M_2 has an acceleration of 4.0 m/sec^2 along this table under the action of the same force. The mass of M_2 in kilograms is

   A. 1.6
   B. 2.0
   [✓ C. 2.5]
   D. 10

$F = ma$ $10 = 2a$ $10/5$ $a = 5$ m/sec^2 $10F = \frac{m}{4}$ $m\ 2(5) = ?(4)$ $20/4$

4. The segment of the graph to the right representing the greatest velocity is lettered

   A. AB
   [✓ B. BC]
   C. CD
   D. DE



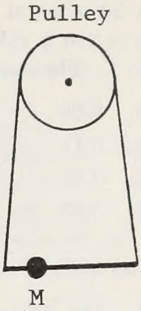
5. A stone that is thrown straight down with a speed of 5.00 ft/sec will, at the end of 3.00 seconds free fall, have a velocity of

   [✓ A. —15 ft/sec]
   B. —96 ft/sec
   C. —101 ft/sec
   D. —159 ft/sec

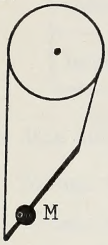
6. A ball is thrown vertically upward from a car moving with constant speed. Which one of the following is the best description of the motion of the ball?

   A. Relative to the car, the path of the ball is a parabola.
   B. Relative to the earth, the path of the ball is vertical, and the ball falls back into the car.
   C. Relative to the car, the path of the ball is vertical, and the ball falls back into the car.
   D. Relative to the earth, the path of the ball is vertical, and the ball falls behind the car.

7. A bar of negligible weight has a large mass, M, on it as shown in the diagram to the right, and is attached to a very light rope which is put over a freely turning pulley and then released. The diagram that best illustrates its final position is



A.



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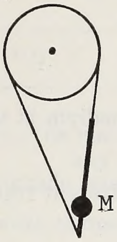
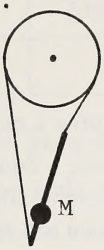
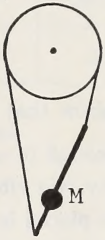


C.



D.



8. A constant horizontal force of 50 newtons is applied to a 3.2×10^2 kg mass starting from rest, on a frictionless horizontal surface. After the mass moves 50 meters it will have a kinetic energy of

A. 6.4 J
B. 2.5×10^3 J
C. 1.6×10^4 J
D. 1.3×10^5 J

9. A hawk in the sky sees a rabbit sitting directly below him. At the time when the rabbit starts to run in a line at 10 m/sec north, the hawk starts to fly north at 20 m/sec on a line 60° below the horizon. If the rabbit and the hawk continue at these velocities the hawk will land

A. in front of the rabbit
B. on the rabbit
C. behind the rabbit
D. at an unknown point because of his unknown height

10. A brick of mass 5.0 kg is pulled 10 m across a horizontal surface for which the coefficient of friction is 0.20. The heat generated as a result of the work done is

A. 2.4 cal
B. 23 cal
C. 98 cal
D. 4.1×10^2 cal

50 m.
7 = hrs.

11. A momentum of 10 kg m/sec can be defined as the momentum of a 10 kg object

A. moving with a velocity of 1 m/sec
B. lifted with a force of 1 newton
C. moving with an acceleration of 1 m/sec^2
D. moving through a distance of 1 meter

12. An object moving in a circular path at uniform speed may be said to be undergoing

A. no acceleration
B. a uniform acceleration toward the center of the path
C. a uniform acceleration away from the center of the path
D. an acceleration which is in the direction of the instantaneous motion

13. A 90 g metal block at 100°C is dropped into 150 g of water at 10°C. The water is contained in a 200 g calorimeter of specific heat 0.09 cal/gC°. The final temperature of the mixture is 15°C. The specific heat of the metal, in cal/gC°, will be

A. 0.09
[✓ B.] 0.11
C. 0.20
D. 0.23

14. The method used to show that sound requires a material medium is to study

A. the intensity of sound in each of a solid, a liquid and a gas
B. sound produced by two vibrating objects of slightly different frequencies
C. a sounding object placed in an evacuated bell jar
[✓ D.] standing waves produced upon a light, flexible silk cord attached to a vibrating tuning fork

15. A weight on a spring bounces up and down reaching its lowest point 20 times in 40 seconds. Its period is

A. .05 sec
B. .08 sec
[✓ C.] .50 sec
D. 2.0 sec

20 : 40
60

$\frac{40}{20} \overset{30}{\times 60}$

$20/40 \times 60$

2 /3

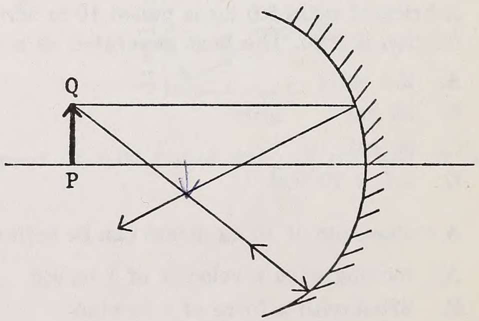
16. In order to demonstrate sympathetic vibrations (resonance), the apparatus required is two tuning forks on sounding boards such that one has a frequency of 250 vibrations per second, and the other a frequency in vibrations per second of

A. 200
[✓ B.] 250
C. 260
D. 300

T.6 V13

17. In the diagram of the concave mirror to the right, the image formed by rays drawn from the object PQ has the characteristics

[✓ A.] real and inverted
B. real and larger than the object
C. virtual and smaller than the object
D. virtual and erect



18. Light of 6.0 x 10^{14}/sec frequency is used in a Newton's Rings apparatus. The thickness of the air space between the lens and glass for the 8th dark ring is

A. 2.5 x 10^{-7} m
B. 1.0 x 10^{-6} m
C. 2.0 x 10^{-6} m
D. 8.0 x 10^{-6} m

6.0×10^{14}

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$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{126}{-10} =$

Use the information below to answer items 19 and 20.

The volume of an enclosed gas versus its temperature at constant pressure is shown in the table below.

volume (ml)	526	546	566	586	606	626	646
temperature (°C)	—10	0	10	20	30	40	5

19. The data above supports the mathematical generalization that

[✓ A.] volume times centigrade temperature equals a constant

B. volume times absolute temperature equals a constant

C. $\dfrac{\text{volume}}{\text{centigrade temperature}} = \text{constant}$

500

D. $\dfrac{\text{volume}}{\text{absolute temperature}} = \text{constant}$

20. The volume of the gas when the temperature is 100°C would be close to

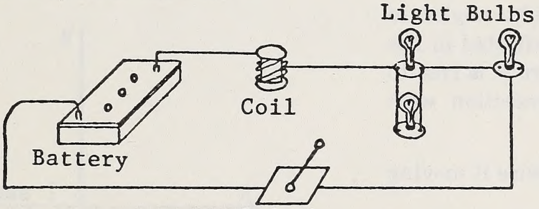
A. 648 ml

[✓ B.] 746 ml

C. 2940 ml

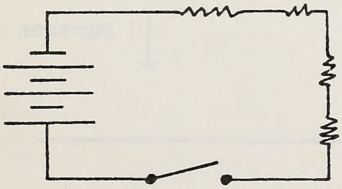
D. 5680 ml

Use the diagram to answer item 21.

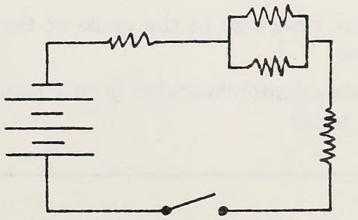


21. The electrical diagram for the above circuit is

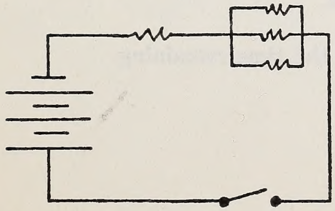
A.



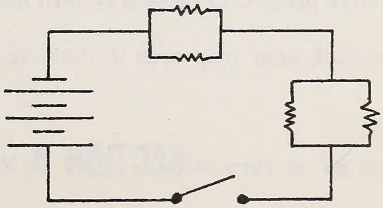
[✓ B.]



C.



D.



1.5 /5

22. If a current of 1.5 amp flows for 5.0 minutes, the number of Cu^{++} ions that could be neutralized would be

A. 2.3×10^{19}
B. 1.4×10^{21}
C. 2.3×10^{24}
D. 1.4×10^{25}

1.5/5
3.1.5 = 50
4.7×10^3
6.35
63.5
63.5
Cu

23. Present research indicates the strength of the earth's magnetic field is decreasing. If this decrease continues to an appreciable extent it can have definite adverse biological implications because

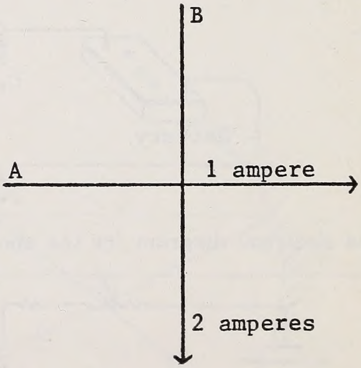
A. there will no longer be any aurora borealis
B. the earth's surface would be less effectively shielded from the constant bombardment by charged particles from outer space.
C. mankind could no longer use the compass as an aid in navigation, thus restricting international trade.
D. the earth's surface would be less effectively shielded from the constant bombardment of meteorites from outer space.

24. At the instant an electric motor is turned on, it draws a large current. As the motor speeds up, the amount of current used is seen to decrease. This change is due to the

A. increased back emf
B. decreased generator effect
C. increased motor effect
D. decreased interaction of magnetic and electric fields

25. Two long, straight, insulated wires are placed on a horizontal surface at right angles to each other, with currents as indicated in the diagram to the right. When wire B is free to rotate about its point of intersection with wire A, wire B will

A. rotate with the bottom of wire B moving into the paper
B. rotate with the bottom of wire B moving out of the paper
C. rotate clockwise in the plane of the paper
D. rotate counterclockwise in the plane of the paper



STOP! DO NOT proceed to Section B until instructed to do so.

You may recheck your responses to items in this Section in the time remaining.

When told to do so, turn to **SECTION B,** Page 8.

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SECTION B

26. A piece of wood whose volume is 250 cm³ floats with 0.600 of its volume below water. The weight of the wood in air is

A. 100 grams

B. 150 grams

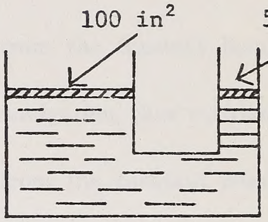
C. 417 grams

D. 625 grams

F = ma. 250/1.6.

$\frac{F}{100} = \frac{25}{5}$

27. The pressure on the small piston of the hydraulic press, in the diagram to the right, is 25.0 lb/in². The pressure on the large piston is



A. 2.50 x 10¹ lb/in²

B. 1.25 x 10² lb/in²

[✓ C.] 5.00 x 10² lb/in²

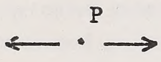
D. 2.50 x 10³ lb/in²

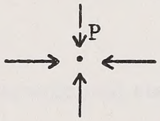
5

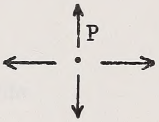
100 : X

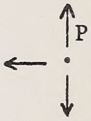
5 : 25

28. The following diagrams represent four systems in which forces (represented by vectors) are acting on a particle P. The diagram which represents an accelerated system is

A. 

B. 

C. 

D. 

29. Two vehicles start at the same time from a given point. One vehicle takes 4.0 hours to travel the same distance as the other vehicle travels in 2.0 hours. This indicates that average speed is

A. inversely proportional to time

[✓ B.] directly proportional to time

C. halved if the time is halved

D. equal to distance times time

4 hr

2 hr

4.0 hr

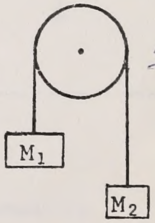
30. A frictionless pulley, as shown in the diagram below, is set up in order to determine the relationship between unbalanced force and acceleration. M_1 is on one end of a string and a smaller mass M_2 is on the other end. To determine the acceleration of the system you could let the system move for

A. one second and measure the distance (d) fallen — acceleration is **d** m/sec²

[✓ B.] a distance (d) and measure the time (t) taken to fall — acceleration is $\frac{d}{t}$ m/sec²

C. a distance (d) and measure the time (t) taken to fall this distance — acceleration is $\frac{d}{t^2}$ m/sec²

D. a distance (d) and measure the time (t) taken to fall (d) — acceleration is $\frac{2d}{t^2}$ m/sec²



$\frac{x}{100} = 125$

31. If the radius of the earth were to double, while its mass remained constant, your weight would be

A. quartered

B. halved

C. doubled

D. quadrupled

F=ma.

πr^2 = [illegible] π · 4.

4π 46 3.4π - x

Use the information below to answer items 32 and 33.

> A man pulls a 50.0 kilogram cart up a 20.0 meter inclined plane to a vertical height of 8.00 meters. Assume that frictional forces are negligible and that velocity of the cart is constant.

32. If (m) is the mass of the cart, (g) the acceleration due to gravity, (ℓ) the length of the plane, and (h) the vertical height of the plane, the force that must be exerted on the rope to maintain the constant velocity is

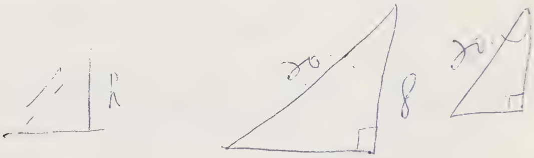
A. $g\left(\frac{h}{\ell}\right)$

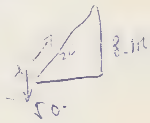
B. $mg\left(\frac{\ell}{h}\right)$

C. $mg\left(\frac{h}{\ell}\right)$

D. mgh

m





100

80 505

W=75ws 80.

33. The work done in moving the cart from the bottom to the top of the plane is

A. 1.96×10^2 J

B. 4.90×10^2 J

C. 1.23×10^3 J

D. 3.92×10^3 J

AC

50 75cosθ.

75cosθ

F

v = 75 sinθ

F = 75 sinθ.

80 =

50x cos 8

---

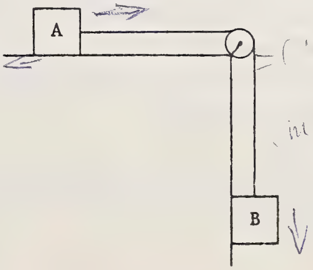
34. The diagram below shows block A of mass M_a and weight W_a resting on a horizontal plane with a force of friction (f) between the block and the plane. Attached to block A by means of a cord passed over a pulley of low friction is block B of mass M_b and weight W_b. When the system is allowed to accelerate, block B moves down. A means of determining this acceleration (a) is

A. $W_b - f = (M_a + M_b)a$

B. $W_b + f = (M_a + M_b)a$

C. $M_b - f = (M_a + M_b)a$

D. $M_b + f = (M_a + M_b)a$



=(Ma+Mb)a.

(ma+mb)a.

35. A student used a slingshot to shoot a steel ball straight up into the air. He recorded only the time it took the ball to return to the ground beside him. Using standard gravity and neglecting air resistance, he now has enough information to calculate which of the following?

1. the maximum height of the ball
2. the initial velocity of the ball
3. the final velocity of the ball

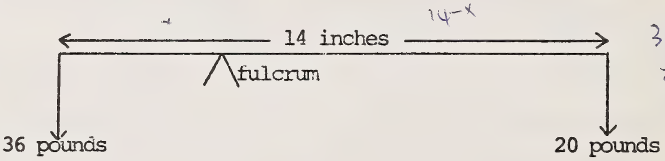
A. 1 only
B. 1 and 2
C. 2 and 3
D. 1, 2 and 3

36. A stone was dropped off a bridge and was seen to strike the water 3.00 seconds later. The height of the bridge was

A. 144 ft
B. 96 ft
C. 48 ft
D. 32 ft

37. A weight of 20 pounds balances a weight of 36 pounds at the extremities of a weightless lever 14 inches long. To maintain the lever in equilibrium, the distance from the fulcrum to the 20 pound weight is

A. 4 inches
B. 5 inches
C. 9 inches
D. 14 inches



$36 \cdot x = 20 \cdot 14 - x$.
$36x = 280 - 20x$
$56x = 280$
$x =$

38. A 50 g aluminum container is filled with 150 g of water at 10°C (specific heat of aluminum = .21 cal/gC°). The heat necessary to raise the temperature of the container and water up to 50°C is

A. 1.7×10^3 calories
B. 4.8×10^3 calories
C. 6.4×10^3 calories
D. 8.0×10^3 calories

39. In order to study the phenomenon called 'beats', the scientist experiments with

A. sound produced by two tuning forks of slightly different frequency
B. resonance in an open organ pipe
C. variation in pitch when a sounding object moves
D. standing waves on a string

40. A tuning fork vibrating 400 times per second produces sound waves in air at 0°C. The wavelength in meters is

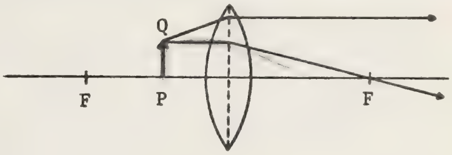
A. 0.80
B. 0.83
C. 0.86
D. 0.89

$f = 400$

$v = 320$
$v = 332$
$v = 344$
$v = 356$.

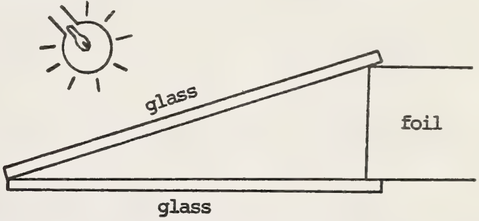
$v = f\lambda$
$\lambda = \frac{v}{f}$

41. In the diagram of the lens below, the rays drawn from object PQ indicate that the image will be



A. virtual and larger than the object
B. real and smaller than the object
C. real and larger than the object
D. virtual and smaller than the object

42. An experiment is set up with two pieces of flat glass placed such that they are in contact along one edge and separated by a piece of foil at the other edge. When monochromatic light shines on the top, dark and bright lines appear on the glass. The statement supported by the experiment is: The dark and bright lines are caused by



A. diffraction of light
B. reflection of light
C. interference of light
D. refraction of light

43. The table below shows the readings of a light meter at three different distances from a constant source. At 0.50 ft from the source, the light meter reading in foot candles is

A. 256
B. 128
C. 32
D. 16

Reading in foot candles	Distance in feet
64	1
16	2
4	4

44. The following data were collected during an experiment which examined the behavior of a gas over a range of pressure with temperature held constant.

Pressure (atmosphere)	Volume (liters)	Pressure × Volume (atm . ℓ)
0.60	20.7	12.4
0.80	15.3	12.2
1.00	12.5	12.5

The volume in liters of this sample of gas at a pressure of 1.2 atmospheres should be approximately

A. 1.2
B. 1.4
C. 10.3
D. 12.5

45. It requires 10.0 newtons to stretch a spring 0.200 meter. The force, in newtons, required to stretch the spring by 2.00 meters is

A. 18.0
B. 20.0
C. 90.0
D. 100

46. An instrument used to detect the presence and nature of an electric charge is

A. an electroscope

B. an ammeter

C. a voltmeter

D. a galvanometer

47. If a person receives a current of about 15.0 milliamps through his body he will receive a shock. If his body has a resistance of about 1200 ohms, the voltage necessary to do this will be

A. 1.25×10

B. 1.8×10

C. 8.0×10^2

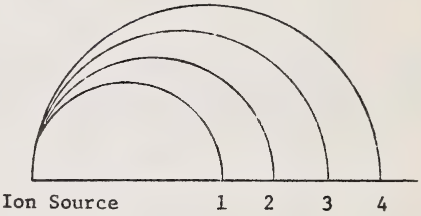
D. 1.25×10^4

$10^{-3} \times 1200$ 1.2

$V = IR$

Use the information and diagram below to answer item 48.

The spectrum to the right was obtained from a mass spectrometer using a sample of hydrogen gas. Due to the presence of a second isotope (deuterium D) five gaseous IONS were produced; H_2^+, HD^+, D_2^+, H^+ and D^+. The atomic weight of deuterium is 2 and all ions have the same initial velocity.



48. Two of the five positively charged ions which form a common spectral line are

A. HD^+ and D_2^+

B. H^+ and D^+

C. H_2^+ and HD^+

D. H_2^+ and D^+

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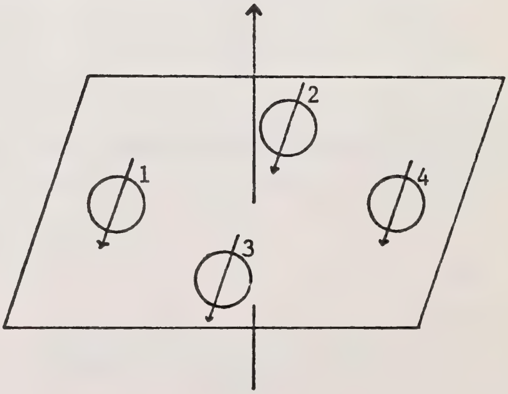
49. If the electrons flow up the wire as indicated in the diagram to the right, then the compass that is pointing in the direction of the magnetic field about the wire is



A. 1

B. 2

C. 3

D. 4

50. Two pieces of germanium are doped; piece A with a small amount of gallium added and piece B with a small amount of arsenic added. Consider the following statements.

1. The germanium will be a poorer conductor of electrons with arsenic added than when pure.
2. Conduction through piece A is described by the migration of positive holes.
3. The arsenic atoms in piece B are called donor atoms.
4. Piece A will have electrons which do not fit readily into the crystal structure.

The CORRECT statements are

A. 2 and 3 only
B. 1 and 2 only
C. 3 and 4 only
D. 2 and 4 only

STOP! DO NOT proceed to Section C until instructed to do so.

You may recheck your responses to items in this Section in the time remaining.

When told to do so, turn to **SECTION C,** Page 14.

SECTION C

51. A piece of metal has a weight of 20.4 grams in air and a weight of 5.8 grams in water. Its specific gravity is

A. 0.4

B. 0.7

C. 1.4

[✓ D. 2.5]

20.4   20.4

20.4 20.4 [illegible]   20.4/5.8   20.4 g

18 [illegible]

52. An example of a scalar quantity is

A. force

B. acceleration

C. speed

D. velocity

15 = 60   10 = 60   15.

10 = x/40   15 = x h   15/h   /40

53. A boat which has a still water speed of 15 miles/hour is used to travel 10 miles up a river, and back to the same dock. If the river flows at 5.0 miles/hour, the round trip will take

A. 0.7 hr

[✓ B. 1.0 hr]

C. 1.3 hr

D. 1.5 hr

d 15/1 = 10.

5/x = 10.

15/hr   5 m/hr   4.0   15 = 10.   15 m/hr

10

54. The following hypothesis was proposed by a physics student.

> "If the force exerted on an object of constant mass is doubled, then the acceleration of the object is doubled."

The hypothesis was tested in an experiment where various forces (F) were exerted on an object of constant mass, resting on a horizontal plane where friction was reduced to a minimum. The object was placed the same distance for each trial. Which one of the following sets of data would support the student's hypothesis?

	Force (newtons)	Time (sec)
A.	F	1
	2F	$\sqrt{2}$
B.	F	$\sqrt{2}$
	2F	1
C.	F	2
	2F	1
D.	F	1
	2F	2

55. A block of mass 5.00 kilograms is lifted 2.00 meters in 3.00 seconds. The work done, in joules, is

A. 6.67

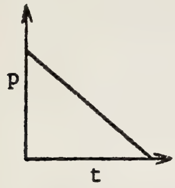
B. 32.7

C. 98.0

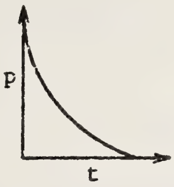
D. 147

56. Where there is no unbalanced force acting on a moving object, the graph of its momentum (p) versus time (t) is

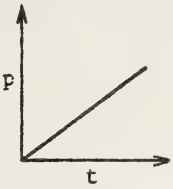
A.



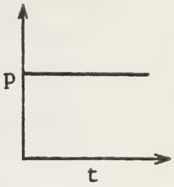
B.



C.



D.



57. A man using a club whose head mass is (M) drives a golf ball of mass (m) from a tee. The speed of the club head before impact is V_1, the speed of the club head after impact is V_2, and the speed of the ball after impact is v_1. The kinetic energy lost during impact is

A. $\frac{MV_1^2 - MV_2^2 - mv_1^2}{2}$

B. $\frac{V_1^2 - V_2^2 - mv_1^2}{V_1^2}$

C. $\frac{V_1^2 - V_2^2}{V_1^2} - mv_1^2$

D. $\frac{V_1^2 - V_2^2}{V_1^2} - \frac{mv_1^2}{MV_1^2}$

58. A 1.5×10^3 kg car is travelling at 30 m/sec on a dry, asphalt highway where the coefficient of friction between the tires and the road is 2.5×10^{-1}. The car encountered a section of wet highway where the coefficient of friction is changed to 1.5×10^{-1}. The radio between the force of friction on dry asphalt to the force of friction on wet asphalt is

A. 0.6:1

B. 1:1

C. 1.5:1

D. 1.7:1

59. A 5.0×10^3 kg space capsule is being lifted off the surface of the moon by rocket engines supplying an upward thrust of 1.0×10^3 newtons for 10 seconds. Assuming the weight of the capsule on the moon to be 8.2×10^2 newtons, the magnitude of the acceleration in m/sec^2 is

A. 3.6×10^{-1}

B. 2.0

C. 3.0×10^2

D. 1.0×10^4

60. An airplane which has a speed of 200 miles/hour in still air is headed due south when there is a 50.0 mile/hour wind blowing toward the east. The magnitude of the plane's resultant velocity with respect to the ground is

A. 194 miles/hour
B. 200 miles/hour
C. 206 miles/hour
D. 250 miles/hour

61. A copper rod 100 centimeters long at —10°C is heated to 90°C. The coefficient of linear expansion for copper is $1.7 \times 10^{-5}/\mathrm{C}^{\circ}$. The change in length of the copper rod, in centimeters, will be

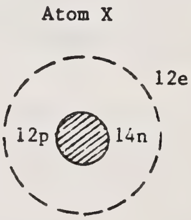
A. 1.7×10^{-5}
B. 1.4×10^{-1}
C. 1.5×10^{-1}
D. 1.7×10^{-1}

62. Some hot coffee loses 150 cal of heat after it is poured into a cup. The heat gained by the cup is 100 cal. The heat gained by the air surrounding the cup would be

A. 50 cal
B. 125 cal
C. 200 cal
D. 250 cal

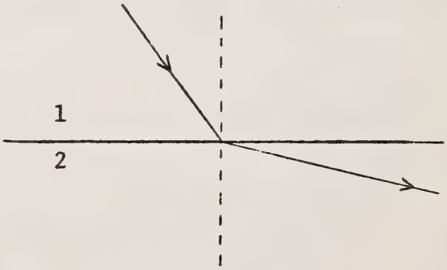
63. The diagram to the right represents the number of protons, neutrons and electrons of the atom X. The symbol which represents the atom is

A. $_{12}X^{26}$
B. $_{12}X^{24}$
C. $_{14}X^{24}$
D. $_{14}X^{26}$



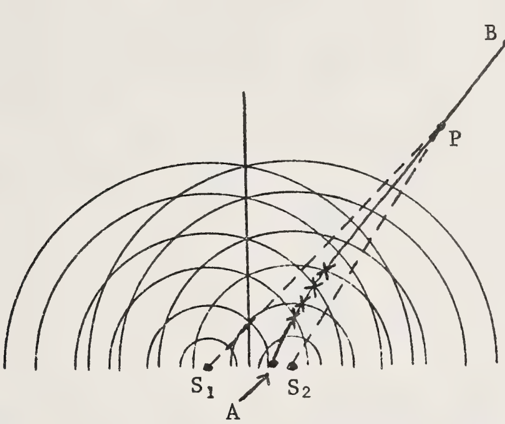
64. A light ray passes from medium 1 into medium 2, as shown in the diagram below. The path of the ray indicates that

A. medium 1 is more dense than medium 2
B. medium 2 is more dense than medium 1
C. the critical angle has been reached
D. medium 2 has a varying density



Use the information below to answer items 65 and 66.

When two point sources are vibrating in a ripple tank the pattern created can be represented by the diagram below.

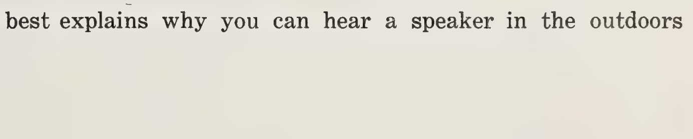


65. Line AB is caused by
    - A. constructive interference
    - B. destructive interference
    - C. waves moving faster than usual
    - D. waves moving slower than usual

66. By analyzing the various spots that are marked "X" along line AB you can generalize that anywhere along line AB, $PS_1 - PS_2$ will be equal to
    - A. 1λ
    - B. $1\frac{1}{2}\lambda$
    - C. 2λ
    - D. $2\frac{1}{2}\lambda$

---

67. In the diagram below, the term used to describe the phenomenon in which the rays do not have a common focal point is
    - A. spherical aberration
    - B. chromatic aberration
    - C. diffraction
    - D. reflection



68. The phenomenon of waves that best explains why you can hear a speaker in the outdoors even if you are behind him is
    - A. refraction
    - B. diffraction
    - C. reflection
    - D. interference

69. The second order image in a diffraction grating is found at an angle of 30° from the light source. If the grating has 10,000 lines/cm, then the wavelength of light used is

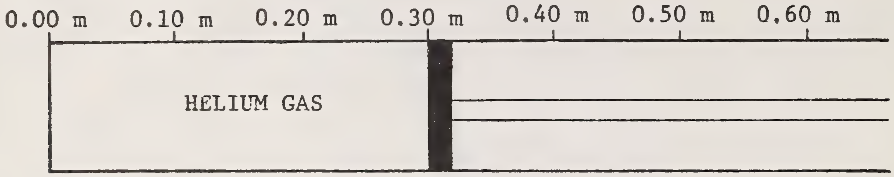
A. 1000 mμ

B. 750 mμ

C. 500 mμ

D. 250 mμ

Use the information below to answer items 70 and 71.



A cylinder has a closely fitting piston that can be moved back and forth, thus varying the volume of an enclosed quantity of helium gas. When the piston is at 0.30 meters the pressure of the gas is 10^5 newtons per square meter and its temperature is 300° Kelvin.

70. The procedure that would double the pressure of gas would be to

A. move the piston to 0.20 meters and raise the temperature to 400° Kelvin

B. hold the piston steady and raise the temperature to 500° Kelvin

C. move the piston to 0.60 meters and hold the temperature constant

D. move the piston to 0.15 meters and raise the temperature to 600° Kelvin

71. If the temperature of the gas is raised while the piston is held steady, in which of the following would there be an increase?

1. the pressure of the gas
2. the number of molecules striking the piston per unit time
3. the average velocity of the molecules

A. 1 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

---

72. Three identical insulated metal spheres have charges as indicated in the diagram below. If Z is touched to Y and then to X, the remaining charge on X will be

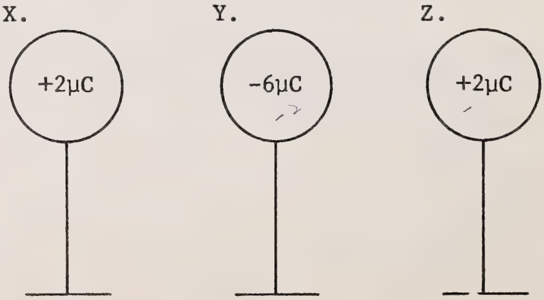
$-6+2=-4$

A. zero

B. $-\frac{2}{3}\mu C$

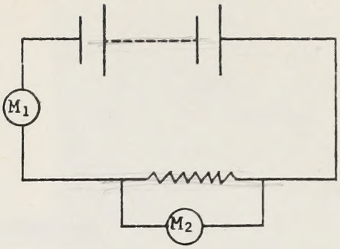
C. $+\frac{2}{3}\mu C$

D. $-\frac{10}{3}\mu C$



73. In electrical circuits you sometimes wish to know:

1. the battery terminal voltage
2. the magnitude of the current
3. the magnitude of the external resistance



Knowing the readings on meters M_1 and M_2 as shown in the diagram to the right, you either know directly or can determine

A. 1 and 2 only

B. 1 and 3 only

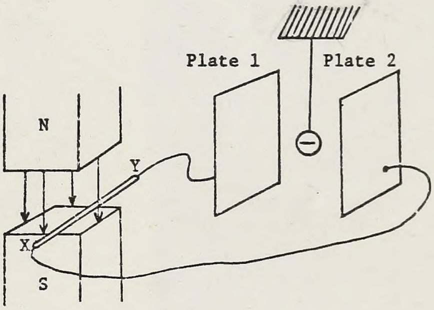
C. 2 and 3 only

D. 1, 2 and 3

Use the following information and the orientation of the equipment as shown in the diagram below to answer items 74 and 75.

> A wire XY is located in a strong magnetic field and is connected to two parallel metal plates, 1 and 2, between which a light, negatively-charged conducting sphere is hung on an insulating thread.

74. When the wire XY is moved rapidly to the left, the sphere will experience a force which will tend to move it



A. out of the paper parallel to the plates

B. into the paper parallel to the plates

C. to the right

D. to the left

75. With wire XY at rest, the charged sphere is now moved so as to touch Plate 2. The wire XY will experience a force which will tend to move it

A. to the left

B. to the right

C. upward

D. downward

You may recheck your responses to items in this Section in the time remaining.

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